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**(54) Title of the invention**

Thermoplastic resin composition dispensing with coating, and parts dispensing with coating

**(57) Summary**

**Solution of problem**

Thermoplastic resin composition dispensing with coating and prepared by compounding component (A) 5 ~ 40, component (B) 5 ~ 40, component (C) 30 ~ 75 and if necessary, component (D) (a specific graft copolymer) 0 ~ 20 (parts by weight). Component (A): emulsion graft copolymer of 30 ~ 85 parts of ethylene-propylene non-conjugated diene copolymer rubber latex and having 50 ~ 95 % gel-content, and 15 ~ 70 parts of a mixture of 60 ~ 80 % aromatic vinyl compound and 20 ~ 40 % vinyl cyanide compound. Component (B): emulsion graft copolymer of 30 ~ 70 parts of bridged acrylate ester rubber and 30 ~ 70 parts of a mixture containing 50 ~ 75 % of an aromatic vinyl compound and 25 ~ 50 % of vinyl cyanide compound. Component (C): suspension copolymer of 0 ~ 65 % methacrylate ester, 20 ~ 40 % aromatic vinyl compound 15 ~ 40 % vinyl cyanide compound and 0 ~ 30 % maleimide compound.

**Effect**

To present a molded product having excellent weather-resistance, impact resistance, surface luster and with almost no pearl-pattern or weld-lines and, having very good external appearance.

## **Scope of the patent application**

### **Claim 1**

Thermoplastic resin composition dispensing with coating and, prepared by compounding 5 ~ 40 parts by weight of component (A), 5 ~ 40 parts by weight of component (B), 30 ~ 75 parts by weight of component (C) and 0 ~ 20 parts by weight of component (D) mentioned below.

Thermoplastic resin composition dispensing with coating, and prepared by compounding the following.

Component (A): Graft copolymer obtained by grafting 15 ~ 70 parts by weight of a vinyl monomer mixture of 60 ~ 80 weight % aromatic vinyl compound and 20 ~ 40 weight % vinyl cyanide compound, on 30 ~ 85 parts by weight of ethylene-propylene-non-conjugated diene copolymer rubber latex having 50 ~ 95 weight % gel-content by emulsion polymerization.

Component (B): Emulsion graft copolymer obtained by grafting 30 ~ 70 parts by weight of a vinyl monomer mixture containing 50 ~ 75 weight % of an aromatic vinyl compound and 25 ~ 50 weight % of vinyl cyanide compound on 30 ~ 70 parts by weight of bridged acrylate ester rubber.

Component (C): A vinyl copolymer obtained by suspension copolymerization of 0 ~ 65 weight % methacrylate ester, 20 ~ 40 weight % aromatic vinyl compound, 15 ~ 40 % vinyl cyanide compound and 0 ~ 30 weight % maleimide compound.

Component (D): Graft copolymer obtained by grafting 25 ~ 60 parts by weight of a vinyl monomer mixture of 60 ~ 80 weight % of aromatic vinyl compound, 25 ~ 40 weight % vinyl cyanide compound and 0 ~ 30 weight % of a vinyl compound (that can copolymerize with these), by emulsion polymerization, on a diene rubber having average particle diameter of 1500 ~ 2800.

## **Claim 2**

A part dispensing with coating, and obtained by molding the thermoplastic resin composition mentioned in Claim 1 above.

## **Detailed description of the invention**

[0001]

### **Technical fields belonging to this invention**

This invention is concerned with thermoplastic resin dispensing with coating, and a part dispensing with coating. Thus it is concerned with a thermoplastic resin composition that can give molded products with excellent weather resistance, surface luster and impact resistance and, molded products of this composition having good external appearance.

[0002] **Conventional methods**

The compositions obtained by copolymerization of aromatic vinyl compounds with vinyl cyanide compound are known as ABS resins. These resins have excellent mechanical strength and fabricability. Many times, from the point of making it weather resistant or from design point of view, these are coated or plated. These are widely used in housing for domestic electric fittings, OA appliances or for automobile parts.

[0003] Resin raw material is widely used in parts of vehicles for making them lightweight, for designing purpose or avoiding rust. ABS resin is one of the representative of these and while using in automobile fittings, the surface of ABS resin products require secondary processing like coating or plating.

**[0004] The problems this invention sought to solve**

Such secondary processing, however, requires a large number of stages. This causes increase in cost and environmental pollution due to the use of solvents in the processing. Thus there was a strong demand for the development of a thermoplastic resin composition that can maintain excellent luster, weather resistance and impact resistance even when used in automobile parts for a long time.

[0005] Patent JP 62-35415, has proposed a thermoplastic resin composition with excellent color tone, impact resistance and weather resistance and obtained by compounding a graft polymer with high rubber-content, core-shell type bridged acrylate ester copolymer as its main component, copolymer consisting of methyl (metha) acrylate ester and thermoplastic resin containing diene rubber. However, there is a requirement for a resin composition with still better weather resistance, impact resistance, external surface appearance and for a resin composition that does not require coating.

[0006] Moreover, the usual resin molded products have weld-lines on their surface. The thermoplastic resin composition molded product mentioned in Patent JP 62-35415 (that uses diene rubber and acrylate ester rubber for reducing the weld-lines and improving the impact strength) has the problems like less surface luster and occurrence of weld-lines or pearl pattern on its surface.

[0007] Objective of the present invention is to present a thermoplastic resin composition dispensing with coating and having excellent weather resistance, impact resistance, surface luster and almost not showing weld-lines or pearl pattern on its surface.

**[0008] Procedure for solving the problems**

Special feature of the thermoplastic resin composition of this invention mentioned in Claim 1 above is that it comprises 5 ~ 40 parts by weight of component (A), 5 ~ 40 parts by weight of component B, 30 ~ 75 parts by weight of component (C) and 0 ~ 20 parts by weight of component (D).

[0009] Special feature of the part dispensing with a coating and mentioned in claim 2 above is that it is obtained by molding the thermoplastic resin mentioned in claim 1 above.

Component (A): graft copolymer obtained by grafting 15 ~ 70 parts by weight of a vinyl monomer mixture of 60 ~ 80 weight % aromatic vinyl compound and 20 ~ 40 weight % vinyl cyanide compound, on 30 ~ 85 parts by weight of ethylene-propylene-non-conjugated diene copolymer rubber latex having 50 ~ 95 weight % gel-content by emulsion polymerization.

Component (B): emulsion graft copolymer obtained by grafting 30 ~ 70 parts by weight of a vinyl monomer mixture containing 50 ~ 75 weight % of an aromatic vinyl compound and 25 ~ 50 weight % of vinyl cyanide compound on 30 ~ 70 parts by weight of bridged acrylate ester rubber.

Component (C): A vinyl copolymer obtained by suspension copolymerization of 0 ~ 65 weight % methacrylate ester, 20 ~ 40 weight % aromatic vinyl compound, 15 ~ 40 % vinyl cyanide compound and 0 ~ 30 weight % maleimide compound.

Component (D): Graft copolymer obtained by grafting 25~ 60 parts by weight of a vinyl monomer mixture of 60 ~ 80 weight % of aromatic vinyl compound, 25 ~ 40 weight % vinyl cyanide compound and 0 ~ 30 weight % of a vinyl compound (that can copolymerize with these), by emulsion polymerization, on a diene rubber having average particle diameter of 1500 ~ 2800.

[0010] After conducting research for development of a thermoplastic resin composition having excellent properties for a resin molded product dispensing with coating, the present inventors found that the above objective can be achieved by compounding specially treated ethylene-propylene-non conjugated diene rubber graft polymer with vinyl copolymer consisting of acrylate ester and graft copolymer containing acrylate ester rubber or if desired, a graft copolymer containing diene rubber having a specific particle diameter. The present invention is based upon this knowledge.

**[0011] Application of this invention**

Details of this invention are given below.

[0012] First, components (A) ~ (D) present in the thermoplastic resin of this invention that does not require any coating, are described individually in the following.

[0013] Component (A) is obtained from a graft copolymer obtained by grafting 15 ~ 70 parts by weight of a vinyl monomer mixture of 60 ~ 80 weight % aromatic vinyl compound and 20 ~ 40 weight % vinyl cyanide compound, on 30 ~ 85 parts by weight of ethylene-propylene-non-conjugated diene copolymer rubber latex having 50 ~ 95 weight % gel-content, by emulsion polymerization. (It might have been mentioned below as 'graft copolymer (A)').

[0014] This emulsion graft polymerization can be carried out for example, by using above mentioned ethylene-propylene-non conjugated diene copolymer rubber latex and vinyl monomer mixture, so that their total quantity becomes 100 parts and by conducting reaction at 70 ~ 95°C in presence of a redox initiator comprising cumene hydro peroxide, ferrous sulphate, sodium pyrophosphate and dextrose and, a chain transfer agent. While doing this, above mentioned polymerization activator comprising ferrous sulphate, sodium pyrophosphate and dextrose is

added in part or desirably 0.3 ~ 0.8 (in weight ratio) of its total quantity in one lot, to the above rubber latex, at the time of initiation of the reaction. At the same time, total quantity of the above polymerization activator vinyl monomer mixture and cumene hydro peroxide is continuously added to the above latex, during a period of at least one hour from the initiation of polymerization. Further, it is better to add the remaining amount of polymerization activator and emulsifying agent to the latex such that its time of addition is at least 30 minutes longer than that for vinyl monomer mixture and cumene peroxide mentioned above.

[0015] For the above ethylene-propylene-non-conjugated diene copolymer latex, it is better that the weight ratio of ethylene and propylene is in the range of 85:15 ~ 30:70. Further, desirable non-conjugated dienes are 1,4-hexadiene, 5-ethylidene-2-norbornane 5-vinyl norbornane, di-cyclo pentadiene etc.

[0016] The vinyl monomer mixture of component (A) that is graft polymerized in ethylene-propylene-non-conjugated diene polymer rubber latex is made from a mixture of an aromatic vinyl compound and vinyl cyanide compound. Aromatic vinyl compounds such as styrene or  $\alpha$ -methyl styrene can be desirably used. Vinyl cyanide compounds like acrylo nitrile or methacrylo nitrile can be desirably used. In such vinyl monomer mixture, the proportion of aromatic vinyl compound should be in the range of 60 ~ 80 weight % and that of vinyl cyanide compound in the range of 40 ~ 20 weight %.

[0017] For the graft emulsion polymerization of the above component (A), especially a redox initiator comprising cumene hydro peroxide, ferrous sulphate, sodium pyrophosphate and dextrose is desirably used, as stated above.

[0018] In addition to the specific redox initiator stated above, by adjusting the quantity of above polymerization activator made from ferrous sulphate, sodium pyrophosphate and dextrose, by adjusting the quantity of cumene hydro peroxide, vinyl monomer compound and emulsifying agent and the time of addition to the latex, moreover, by conducting the reaction continuously in absence of ring transfer agent and by reducing the quantity of emulsifying agent to 1/3 of the conventional one, it is possible to get the graft copolymer (A) with excellent properties, with a higher conversion percentage, by increasing polymerization stability at each step.

[0019] Component (B) is a graft polymer obtained by emulsion graft polymerization of 30 ~ 70 parts of a vinyl monomer mixture made from 50 ~ 70 weight % of an aromatic vinyl compound and 25 ~ 50 weight % of vinyl cyanide on 30 ~ 70 weight % of a branched alkyl acrylate ester rubber. (It might have been mentioned below as ‘graft polymer (B)’).

[0020] Examples of alkyl acrylate esters forming this rubber component are methyl acrylate, ethyl acrylate, propyl acrylate, butyl acrylate. Butyl acrylate is, however, used desirably. As for bridging agents used for bridging the alkyl acrylate units is a bridge type monomer having at least two C = C. The examples of this are esters of triallyl cyanurate or triallyl isocyanurate with unsaturated alcohol; divinyl compounds like divinyl benzene; diallyl compounds, dimethacryl compounds like ethylene glycol dimethacrylate. Tri-allyl isocyanurate is especially desirable.

[0021] Examples of vinyl cyanide compound of vinyl monomer compound (unsaturated nitrile unit) are acrylo nitrile and methacrylo nitrile. However, acrylonitrile can be used desirably. Further, styrene,  $\alpha$ -methyl styrene, halogenated styrene can be used as aromatic vinyl compounds (aromatic vinyl unit). Styrene is, however, desirable.

[0022] Component (C) is a vinyl copolymer obtained by suspension polymerization of 0 ~ 65 weight methacrylate ester, 20 ~ 40 weight % aromatic vinyl compound, 15 ~ 40 weight % vinyl cyanide compound and 0 ~ 30 weight % maleimide compound. (It might be mentioned below as 'vinyl copolymer (C)').

[0023] Methyl methacrylate is desirable example of methacrylate ester of component (C) however, ethyl methacrylate, propyl methacrylate, butyl methacrylate, cyclohexyl methacrylate, hydroxyethyl methacrylate can also be used. Moreover, styrene,  $\alpha$ -methyl styrene, chloro styrene can be used as desirable aromatic vinyl compounds. As for vinyl cyanide compound, acrylonitrile or methacrylo nitrile is desirable. Maleimide, N-methyl maleimide, N-ethyl maleimide, N-cyclohexyl maleimide, N-tolyl maleimide can be used as maleimide. By conducting suspension polymerization of these in definite proportion and by the usual method, vinyl copolymer of component (C) is obtained.

[0024] Component (D) is a graft copolymer obtained by polymerization of 25 ~ 60 weight % of vinyl monomer compound composed of 40 ~ 75 weight % of diene rubber of average particle diameter of 1500 ~ 2800  $\mu$ , 60 ~ 80 weight % aromatic vinyl compound, 25 ~ 40 weight % vinyl cyanide compound and 0 ~ 30 of a vinyl compound that can be copolymerized with these. (It might have been mentioned below as 'graft copolymer (D)').

[0025] Diene rubber of component (D) is the one having average particle size as 1800 ~ 2200  $\mu$  and having 80 ~ 99 weight % gel content. The one with more than 95 % gel content is especially better. Moreover, in this invention it is important that the average particle size and gel content of this diene rubber is in the range mentioned above.

[0026] The graft copolymer of component (D) is prepared by graft polymerization of 60 ~ 80 weight % of aromatic vinyl compound and 25 ~ 40 weight % vinyl cyanide compound and if necessary with 0 ~ 30 weight % of a polymerizable vinyl compound (so that the total becomes 25 ~ 60 parts by weight) of polymerizable vinyl compound in presence of 40 ~ 75 parts by weight (converted into dry weight) of elastic diene rubber latex.

[0027] Further, examples of aromatic vinyl compounds that can be used in the synthesis of graft polymer (D) are styrene and  $\alpha$ -methyl styrene. Examples of vinyl cyanide compound are acrylonitrile and methacrylo nitrile. Those of polymerizable vinyl compound are phenyl maleimide and methyl methacrylate. Thermal decomposition type initiators like potassium per sulphate, ammonium persulphate (that are usually used in ABS graft polymer) or redox type initiator organic hydro peroxide/ iron chloride is good as polymerization initiators. There is no specific restriction on the method of addition of these initiators. Thus they can be added in one lot, by dividing into several lots or continuously.

[0028] While using an emulsifying agent in the synthesis of the graft copolymer (D), there is no specific restriction. Thus anionic surface-active agents of potassium oleate, potassium salt of disproportionate rosin acid can be used. While using chain transfer agents, there is no specific restriction and, mercaptans,  $\alpha$ -methyl styrene dimer or terpins can be used.

[0029] Thermoplastic resin composition dispensing with coating is obtained by compounding these components (A) ~ (D) as, 5 ~ 40 parts by weight of component (A), 5 ~ 40 parts by weight of component (B), 30 ~ 75 parts by weight of component (C) and 0 ~ 20 parts by weight of component (D).

[0030] In this invention, if the proportion of component (A) is less than 5 weight %, it is not possible to obtain excellent weather resistance and impact resistance. If, however, it is more than 40 weight %, the ability of formation, and thermal resistance are affected.

[0031] If the proportion of component (B) is less than 5 weight %, it is not possible to get excellent weather resistance and impact resistance and if it exceeds 40-weight %, forming ability and thermal resistance are affected.

[0032] If the proportion of component (C) is less than 30 weight %, it is not possible to get excellent surface luster and forming ability, and if it exceeds 75 weight %, the impact resistance is affected.

[0033] Further, component (D) may not be used in the composition. However, excellent low temperature impact resistance is obtained when component (D) is compounded up to 20 parts by weight.

[0034] Further, the thermoplastic resin of this invention may contain additives like thermal stabilizers and if desired, lubricants, mold releasing agents, fuel releasing agent, ultra violet radiation absorbers, electric charge preventing agents in addition to the above components. Further, glass fiber, carbon fiber, talc, calcium carbonate etc can be added for providing strength.

[0035] Thermoplastic resin composition of this invention can be obtained by mixing the above components (A) ~ (D) and the above additives, in a definite proportion in a mixing device like Henshell mixer, V-type blender or tumbler, and conducting fused mixing in a fused mixing device like mono axial extrusion machine, biaxial extrusion machine, banbari mixer, co-kneader or roll and there is no specific restriction.

[0036] The molded product that does not require coating can be prepared by molding the thermoplastic resin (that does not require coating), by the usual method like injection molding, extrusion molding, blow molding, sheet molding or vacuum molding, to get it in the desired shape.

[0037] Such molded products can be used in door mirrors of cars, radiator grills, rear finisher, wheel caps, consol boxes, instrument panel, steering wheel cover, or covering of two wheelers. It can also be used in panels of OA appliances, housing for domestic electrical fittings such as television, stereo, radio, air conditioner or video. It gives excellent surface luster, impact resistance and weather resistance.

#### **[0038] Application examples**

This invention is further explained by giving application and comparison examples. However, it is not restricted to these examples except for the essential points.

#### **[0039] Production example 1**

##### **Preparation of graft copolymer (A)**

170 parts by weight of distilled water, 60 parts by weight of ethylene-propylene-non conjugated diene copolymer rubber (average particle diameter 3000  $\mu$ ) consisting of 5-ethylidene-2-norbornane as the non-conjugated diene component and having 90 weight % gel content, 0.01 parts by weight of sodium hydroxide, 0.45 parts by weight sodium pyrophosphate, 0.01 parts by weight of ferrous sulphate and 0.60 parts by weight of dextrose were placed in a reactor provided with stirrer and the temperature was raised to 80°C. Then 30 parts by weight of vinyl monomer mixture consisting of 30-weight % acrylonitrile and 70-weight % styrene was prepared. This mixture and a mixture containing 1.0 weight % cumene hydro peroxide, 30 parts by weight of distilled water, 0.45 parts by weight of sodium pyrophosphate, 0.01 parts by weight of ferrous

sulphate, 0.56 parts by weight of dextrose, 1.0 part by weight sodium salt of oleic acid were added continuously to the above reactor during a period of 180 minutes. Then the reaction was carried out for 60 minutes at 80°C to get graft polymer with various particle diameters (A: A-1, A-2, A-3). Percentage of conversion of the monomer mixture was 96 % and deposition of condensed substance was 0.22 weight %.

#### **[0040] Production example 2**

##### **Preparation of graft polymer B**

40 parts by weight of vinyl monomer mixture made from 65 weight of styrene and 35 weight % acrylonitrile, 0.20 parts by weight of benzoyl peroxide and 0.05 parts by weight of t-dodecyl mercaptan were added continuously to 60 parts by weight of n-butyl acrylate rubber while bridging by means of tri-allyl isocyanulate. The period of addition was 3 hours. This gave graft copolymers of various average particle diameters (B: B-1, B-2, B-3). Average particle diameter of bridged rubber was 3000  $\oplus$ .

#### **[0041] Production example 3**

##### **Preparation of vinyl copolymer (C)**

0.003 parts by weight of sodium salt of alkylbenzene sulphonic acid and 100 parts by weight of monomer mixture consisting of 30 weight % methyl methacrylate, 30 weight % styrene and 20 weight % acrylonitrile, and 0.6 parts by weight t-dodecyl mercaptan, 0.15 parts by weight of benzoyl peroxide, 0.50 parts by weight of calcium phosphate were added to 120 parts by weight of distilled water. Then suspension polymerization was carried out at 110°C for 10 hours to get vinyl copolymer (C-1). Percentage conversion of the monomer was 92 %.

[0042] Vinyl copolymer (C-2) was prepared separately as above, but without using methyl methacrylate.

**[0043] Production example 4**

**Preparation of graft copolymer (D)**

60 parts by weight of diene rubber of gel content 98 % and average particle diameter 2000  $\oplus$ , 40 parts by weight of vinyl monomer mixture consisting of 70 weight % styrene and 30 weight % acrylonitrile, 1 part by weight of potassium salt of disproportionate rosin acid, 0.04 parts by weight of potassium hydroxide, 0.08 parts by weight of t-dodecyl mercaptan and 0.6 parts by weight of potassium persulphate were added to 200 parts by weight of distilled water. The reaction was initiated from 60°C. In the middle the temperature was raised to 75 °C. The polymerization was stopped after 2 hours, to get graft copolymer (D). Conversion of the monomer was 95 weight %.

**[0044] Application examples 1 ~ 6 and Comparison examples 1 ~ 4**

The polymers obtained in the above production examples 1 ~ 4 were mixed uniformly in a V-type blender. The mixture thus obtained was subjected to fused mixing in a biaxial extrusion machine of 4 mm diameter and at barrel temperature 260°C. The fibres coming out from the die were cut to get pellets for molding. These pellets were pressed by means of 5-ounce injection molding machine by fitting a test piece die and under the conditions of cylinder temperature 260°C, die temperature 80°C, injection pressure 100 kg/cm<sup>2</sup>, cooling time 30 seconds, to get a test piece.

[0045] Various properties were evaluated and averaged for each test piece. The results are shown in Tables 1 and 2.

[0046]

**Table 1**

|               |      | Application example |     |     |     |     |     |
|---------------|------|---------------------|-----|-----|-----|-----|-----|
|               |      | 1                   | 2   | 3   | 4   | 5   | 6   |
| Copolymer (A) | Type | A-1                 | A-1 | A-1 | A-1 | A-1 | A-1 |

|  | Weight (%)              | 10  | 25  | 40  | 15  | 15  | 25  |
|--|-------------------------|-----|-----|-----|-----|-----|-----|
| Copolymer (B)  | Type                    | B-1 | B-1 | B-1 | B-1 | B-1 | B-1 |
|  | Weight (%)              | 40  | 25  | 10  | 15  | 15  | 25  |
| Copolymer (C)  | Type                    | C-1 | C-1 | C-1 | C-1 | C-1 | C-2 |
|  | Weight (%)              | 50  | 50  | 50  | 70  | 50  | 50  |
| Copolymer (D)  | Type                    |     |     |     |     | D   |     |
|  | Weight (%)              |     |     |     |     | 10  |     |
| Izot impact strength ASTM D256<br>(kg-cm/cm)   |                         | 26  | 30  | 35  | 20  | 40  | 32  |
| Melt flow rate ASTM D1238<br>220C/10kgf (g/10 min)                                       |                         | 16  | 16  | 15  | 20  | 18  | 14  |
| Thermal deformation temp.<br>ASTM D648 18.6 kg/cm <sup>2</sup> (°C)                      |                         | 90  | 90  | 90  | 91  | 90  | 92  |
| External appearance  | Surface luster (%)      | 96  | 95  | 96  | 97  | 97  | 93  |
|  | Conspicuousness of weld | ①   | ①   | ①   | ①   | ①   | O   |
| Weather resistance External appearance<br>Sunshine weather meter<br>2000 Hrs irradiation |                         | ①   | ①   | ①   | ①   | ①   | O   |
| Product performance evaluation   | External appearance     | ①   | ①   | ①   | ①   | ①   | C   |
|  | Heat resistance         | ①   | ①   | ①   | ①   | ①   | ①   |
|  | Impact resistance       | ①   | ①   | ①   | O   | ①   | ①   |

① : Excellent, V: good, X: not good

A-1 Copolymer (A) with average particle diameter 4000 Å

B-1 Copolymer (B) with average particle diameter 3000 Å

A-2 Copolymer (A) with average particle diameter 3000 Å

B-2 Copolymer (B) with average particle diameter 2000 Å

A-3 Copolymer (A) with average particle diameter 5000 Å

B-3 Copolymer (B) with average particle diameter 4000 Å

Table 2

|                                      |                              | Comparison example |     |     |     |
|--------------------------------------|------------------------------|--------------------|-----|-----|-----|
|                                      |                              | 1                  | 2   | 3   | 4   |
| Copolymer<br>(A)                     | Type                         | A-2                | A-3 | A-1 | A-1 |
|                                      | Weight (%)                   | 25                 | 25  | 25  | 25  |
| Copolymer<br>(B)                     | Type                         | B-1                | B-1 | B-2 | B-3 |
|                                      | Weight (%)                   | 25                 | 25  | 25  | 25  |
| Copolymer<br>(C)                     | Type                         | C-1                | C-1 | C-1 | C-1 |
|                                      | Weight (%)                   | 50                 | 50  | 50  | 50  |
| Copolymer<br>(D)                     | Type                         |                    |     |     |     |
|                                      | Weight (%)                   |                    |     |     |     |
| Izot impact strength                 | ASTM D256 (kg-cm/cm)         | 24                 | 20  | 18  | 16  |
| Melt flow rate                       | ASTM D1238                   | 14                 | 13  | 15  | 13  |
| 220C/10kgf                           | (g/10 min)                   |                    |     |     |     |
| Thermal deformation temp.            |                              | 90                 | 90  | 90  | 90  |
| ASTM D648                            | 18.6 kg/cm <sup>2</sup> (°C) |                    |     |     |     |
| External<br>appearance               | Surface luster (%)           | 85                 | 84  | 82  | 81  |
|                                      | Conspicuousness of weld      | X                  | X   | X   | X   |
| Weather resistance                   | External appearance Sunshine | O                  | O   | O   | O   |
| weather meter                        | 2000 Hrs irradiation         |                    |     |     |     |
| Product<br>performance<br>evaluation | External appearance          | X                  | X   | X   | X   |
|                                      | Heat resistance              | ①                  | ①   | ①   | ①   |
|                                      | Impact resistance            | O                  | O   | X   | X   |

① : Excellent, V: good, X: not good

|     |   |     |   |
|-----|---|-----|---|
| A-1 | Copolymer (A) with average particle diameter 4000 Å | B-1 | Copolymer (B) with average particle diameter 3000 Å |
| A-2 | Copolymer (A) with average particle diameter 3000 Å | B-2 | Copolymer (B) with average particle diameter 2000 Å |
| A-3 | Copolymer (A) with average particle diameter 5000 Å | B-3 | Copolymer (B) with average particle diameter 4000 Å |

[0048] From Tables 1 and 2 it is clear that by the method as per this invention it is possible to produce a molded product with excellent impact strength, external appearance and weather resistance.

**[0049] Effect of this invention**

As it is explained in detail above, by the thermoplastic resin composition of this invention, it is possible to produce a molded product with excellent weather resistance, impact strength, surface luster, without occurrence of pearl pattern or weld-lines, having better external appearance and without the need for coating.